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Family-Friendly Science: Increasing Family Engagement in STEM Education

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HNRS 4990

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December 12th, 2016

BIXLER FAMILY-FRIENDLY SCIENCE 2

I. Research Question

- a. How can early childhood teachers effectively engage families in the education of their children?
- b. Specifically, how can early childhood teachers effectively engage families in science education?

II. Rationale

Family engagement is vital to a child's success in his or her academic career (Brown, Reveles, & Kelly, 2005). Current research has focused more specifically upon the relationship between parent engagement in science, technology, engineering and math (STEM) education and a student's success in his or her STEM education (Falk, 2001; Harris Interactive, 2011; Ing, 2014; and Miller, 2016). All research reviewed demonstrated a positive correlation between these two variables. This means that if a teacher desires to help his or her students reach high levels of achievement, family engagement is key to that endeavor.

When students do not have role models at home for science learning, scientific concepts will often remain abstract and understanding will be unattainable (Brown, Reveles, & Kelly, 2005). Parents and families can serve as role models, and they needn't even understand science concepts. The focus of parent and family engagement should be demonstrating interest and enthusiasm for science in front of their child (Leonard, 2015). The focus of engaging parents and families should not be to turn them into experts on highly specified STEM topics, it should be to create opportunities for them to display that interest and enthusiasm (Leonard, 2015).

Several studies and resources (Tables 1 and 2) support the theory that learning opportunities outside of school are integral to science education. Making science a fun, family-friendly activity has been proven to lead to positive outcomes in scientific literacy, particularly

when it occurs in the child's natural environments (Falk, 2001). Students are better able to process abstract scientific concepts when there is some connection with everyday life (Brown, Reveles, & Kelly, 2005). Having activities that exist outside of the classroom and relate to a child's world will ultimately lead to increased student success in STEM (Miller, 2016).

In Katie Ridnour's *Everyday Engagement: Making Students and Parents Your Partners in Learning*, she details proven methods for engaging parents and families in a student's education. One of the methods she proposes is the empowerment of parents and families to take an active role in their child's education. This contrasts with the role of parents and families as passive contributors who look to a classroom teacher to guide them in activities such as homework. Rather, if parents understand their vital role and feel capable of making unique contributions to their child's education through other at-home activities, they will be more inclined to do so (Ridnour, 2011).

The present literature (Tables 1 and 2) indicates that 1) parent and family involvement is essential to student achievement, 2) parent and family involvement is essential to student achievement in STEM, 3) carrying out activities and demonstrations at home is essential to scientific literacy, and 4) empowering parents and families to be active contributors to their child's science education leads to increased success. These findings led to the accompanying methodology and research.

III. Project Overview

This project began in spring 2016. The student researcher commenced background planning and preparation, and completed HNRS 4980, including a literature review and research proposal. Receiving funds from a CURS (Center for Undergraduate Research and Scholarship) grant, the student researcher utilized a variety of articles, texts and other materials to complete

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scholarly research related to the topic. Methodology, survey questions, and logistical elements were all addressed at this time. The student researcher determined that in order to obtain more knowledge about the topic, it would be of great use to somehow obtain data directly from families. This evolved into proposed participation in the 2016 STEM in the Park event, where the student researcher and faculty mentors would survey families, provide them with a take-home activity, and measure family attitudes following this activity engagement via a second survey. At the end of spring 2016, the student researcher participated in the CURS Spring Symposium to present the scholarly research. This project continued into summer 2016, when final activities for STEM in the Park were determined based on the literature reviewed in Spring, 2016. During this time, the student researcher also familiarized herself with Ohio's New Learning Standards for Science to strengthen her understanding of educational expectations. Permission for participation in STEM in the Park was secured at the end of summer 2016. Preliminary work on obtaining HSRB approval for research also occurred at this time.

In fall 2016, the student researcher and mentors prepared for STEM in the Park. Necessary materials were purchased, and activity packets were assembled. HSRB approval was obtained on September 20th, 2016. Several weeks into the semester, the event was held on September 24th, 2016. Activity packets were distributed, and almost 70 individuals or families agreed to be participants in the research. These participants completed the first survey at the event, using a provided iPad, and were given a take-home activity to do at a later time. Five weeks later, a reminder was sent to all participants who had left contact information. This reminder prompted them to complete the second survey, regardless of completion of the provided take-home activities. Only 7 (10%) of initial participants completed the second survey. Few included the necessary information to link the first and second survey. This rendered the

initial purpose of this study, to learn about family response to take-home engagement activities, moot. However, the results of the first survey still serve as an overview of family attitudes towards STEM education, which can help support engagement strategies used in the future.

IV. Activities

Each activity distributed at STEM in the Park was based around physical science. In the first activity, the focus was on classifying objects based on properties. In the second activity, this focus was on applying changes to objects. In the third activity, the focus was on applying changes to objects and determining that there is no loss of mass. All activities are specific to a grade or developmental level, and relate to a specific Ohio Learning Standard for Science. Families were encouraged to take the packet that best fit their child's profile in relation to grade or developmental level. More details about the activities, including the contents of activity packets and the instruction related to these activities, can be found in Appendix C: Activity Instructions and Related Materials.

V. Methodology

To answer the proposed research questions, the student researcher held a table at STEM in the Park, an event held every fall at Bowling Green State University. The event draws in area families to participate in showcase of STEM-related demonstrations and activities that relate to students and families. The student researcher carried short demonstrations of physical science, and distributed home activity packets that were tiered by grade level. These demonstrations were based on the science of making "s'mores." The focuses were the Ohio State Science Standards that are described in Appendix C: Activity Instructions and Related Materials. There were three packets; one aimed at students in preschool and kindergarten, one at students in first and second grade, and one at students in third grade and beyond. The lesson and activities were the creative

endeavor of the student researcher, and they were finalized in the first weeks of the fall 2016 semester.

In order to take one of these activity packets, parents and families were asked (but not required) to complete a pre-survey (see Appendix B: Survey Questions) and asked to respond to the student researcher with answers to a post-survey (see Appendix B: Survey Questions) five weeks after STEM in the Park. The purpose of the pre-survey was to establish the family's attitudes towards STEM, and their impressions of the student researcher as an educational professional. The purpose of the post-survey was to evaluate the family's attitudes towards the project and their opinions of the collaboration that took place between themselves and the student researcher.

This project was a culmination of the student researcher's previous involvement with STEM in the Park. It was also based upon work in previous courses regarding parent and family engagement. The purpose of the project was to research parent and family engagement in a manner that is practical, innovative, and makes use of resources that the student researcher has previously encountered at Bowling Green State University. This project also integrated both education and science to answer questions that are of importance to both disciplines. The faculty advisors involved in this project were of the two separate colleges at Bowling Green State University that house these two disciplines. This ensured that the research that was collected in this project was guided by and for the benefit of both disciplines.

The activities distributed, regardless of grade-level, had components of inquiry-based learning and whole-family interaction. The specific science focus was designated as learning

about the physical science and matter. This ensured that the activities were appropriate to the goal of getting parents and families involved in the student's learning.

The research design employed was a group design. Participants were families who attended the STEM in the Park activity. The surveys evaluated family attitudes towards the project and its ability to empower parents in contributing to their student's learning. Most of the questions in the two surveys were rating scales of 1-5, with "5's" being the most positive response to the question. The pre-survey was administered online via an iPad at the STEM in the Park.

The dependent measure was comparisons made between: pre- and post-activity involvement, and age groups and parent engagement in the activity. Participants were anonymous. Participants were assigned a number at STEM in the PARK; this number was prewritten on the activity bag the participant took home. The participant entered the number in the post-survey online after engaging in the activity or after being reminded via email by the student researcher.

Social validity measured parent perception of the importance of STEM and the importance of home-based STEM activities. Questions in the survey addressed both of these measures pre- and post-activity. If the parent reaction to questions regarding feelings of empowerment in a student's learning and their overall satisfaction with the project were positive (more than half responding with "4's" and "5's") the study will be considered socially relevant. Because a negligible amount of participants responded for the second survey, this did not apply.

Treatment Fidelity was addressed with a checklist for the student researcher to follow to ensure accurate and reliable training on the activity for all parents.

VI. Results

The goal of this research was to support the effectiveness of a previously established factor affecting family engagement: families' feeling of empowerment to take part in their child's learning. The results of this research were expected to highlight the importance of forming a collaborative relationship with families, and for being a support for them in the at-home education of their child. While the scholarly portion of research accomplished this during the spring 2016 semester, the field-based research results were less conclusive. Of the 70 initial participants, only 7 responded to the second survey. This was despite respectful and professional prompting from the student researcher, and an incentive for participation (being entered into a raffle for a family membership to Imagination Station.) The possible reasons for this might include: the hectic nature of one's life with small children, inactive email accounts, or a disinterest in the incentive. Due to this low participation rate, only the results of the first survey have been analyzed and included.

Overall, the results indicated that families have an almost universally positive and confident attitude about the STEM education of their children (Appendix B). This could be due to the nature of the data collection (self-reporting,) or the audience (attendees at an event of specific STEM interest.) This positive response exceeded expectations; this is especially notable in questions 1 and 2. Both of these questions addressed the child's interest in STEM, specifically science. Around 90% of families reported that their children had an interest in these areas. However, only around 60% of families reported that a family member had a STEM background. This indicates a need to focus on families who have an interest, but no background, in supporting STEM education.

The responses continued to be positive; approximately 90% of families reported attending a STEM-related resource center (such as Imagination Station or the Toledo Zoo) at least once a year. Again, the high number of families who already take advantage of such programs could have been due to the audience participating in the study. In regards to viewing STEM as an important subject cluster in education, and as a field that they desired their children to enter, over 90% of families responded positively. This demonstrates that there are many people who are interested in advancing STEM education, and that we need to consider supports for families who may wish to do so at home.

However, few people (16.4%) rated their child's STEM education as being the best it could be. While many participants still responded positively, there is obviously a need to meet high expectations from families in regards to STEM education. Again, while many people (%) were "satisfied" in their ability to support their child's STEM education, few (25.4%) were "highly satisfied." This indicates a need for increased support in this area, so that all families may feel "highly satisfied." Most participants indicated a high desire for increased STEM-related activities that could be sent home with students. This fulfilled the original expectation that this category of activity could be very beneficial in increasing family engagement in STEM education. It is a practice that should receive increased attention and delivery to ensure the success of all students.

VII: Personal Reflection

Above all, I desired for this project to serve the families and children of Northwest Ohio. I would have preferred to see a greater number of participants return for the second survey; this would have helped myself and those who viewed the results to create home-based science activities that met the wants and needs of families. However, I am pleased with the outcome of

my participation in STEM in the Park. I met a variety of families whom I would otherwise not have come into contact with. The children who attended my table were all extremely excited to engage in the activities. Although I did not receive very many responses for the second survey, the attitudes of families and children in relation to the activities have led me to believe that many did, in fact, complete the activity. If they did, it is my hope that they completed it together, as this is one of the most important factors of increasing student success. I am glad to have had the opportunity to engage with families and, hopefully, have contributed to that “togetherness.”

This project had many implications for how I will approach certain practices in my future classroom. I have a better understanding of communicating with families, both in a face-to-face setting and via email. I also have a better understanding of how I would like to distribute homework to my students and their families. Based on this experience, I believe it would be beneficial to distribute activity packets that resemble those I created for STEM in the Park. I do not have data from the second survey that supports this, but it is something I inferred through my interactions with families. I do have data (outlined in Section II: Rationale) that supports the idea of home-based activities. These kinds of experiences help children to relate to science, and ensure an increased amount of classroom success. I would like to demonstrate this in my own classroom for the benefit of my students.

This project has also helped me to grow as a professional. It took an immense amount of planning, coordinating, and time. I developed a rapport with Bowling Green State University faculty members, and learned powerful skills for engaging with other educational professionals. I had to challenge myself in my organization, and in my management of my time. I became more familiar with not only the Ohio Learning Standards for Science, but with the resources that are available to help engage families in science. I found many examples of home-based activities

online; although none of my activities closely resembled them, I still found benefit in what I learned. There are a variety of individuals and resources that will help me to become a better teacher; now I am adept at taking advantage of them. Ultimately, this will be of benefit to my students. Creating an environment that is engaging and responsive to every child's learning needs is my utmost priority as a young educational professional.

VII. Appendix A: Present Research

Table 1: Research Articles

Studies researching parent engagement and child success in STEM.

Author (year)	Participants	Setting	What did they measure?	Outcomes?
Brown, B. A., Reveles, J.M., & Kelly, G. J. (2005)	Fifth-grade students	Low-income K-8 school in large, metropolitan city in the Midwestern United States; Students predominantly African-American	The relationship between sociocultural identity and scientific literacy	Scientific literacy is dependent upon a child's sociocultural identity, including the role models in a child's life and community
Harris Interactive (2011)	College students pursuing STEM careers and their parents	Unknown, anonymous survey	The participants various perceptions about K-12 STEM education	Both parents and students agreed that early STEM education is key to literacy in STEM subjects, and the eventual willingness to enter a STEM field
Ing, M. (2014)	Seventh-grade students	Various middle schools in United States	The relationship between parental motivational practices, children's mathematics achievement trajectories, and persistence in STEM careers	Parental motivation (i.e. telling students they are proud of success) is essential to student STEM success and eventual entrance into a STEM

Miller, J. (2015)	K-12 students	Various schools across the United States	The correlations between a student's desire to enter a STEM field and three variables; activities outside the classroom, parent aspirations, student self-beliefs	field All correlations positive
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Table 2: Academic Books

Author (year)	Title	Summary
Aikenhead, G. S. (2006)	<i>Science Education for Everyday Life: Evidence-Based Practice</i>	The text explores a humanistic perspective on science education, and summarizes research that has supported the necessity of science education programs that incorporate science connections to everyday life. It outlines two models of science education: “included” and “excluded.” “Included” is focused upon student experiences and contextualizing science concepts, while “excluded” does not.
Bybee, R. W. (2013)	<i>The Case for STEM Education: Challenges and Opportunities</i>	This work establishes the historical and contemporary contexts of STEM education and guidelines for addressing STEM subjects in the classroom. It also presents the challenges facing STEM education, including the need to make the education of STEM subjects relevant to students. The approaches emphasized in this book focus upon nurturing competency of STEM subjects through addressing situations, problems, and issues to which students can personally relate.
Constantino, S. M. (2008)	<i>101 Ways to Create Real Family Engagement</i>	This compilation of family engagement strategies that were submitted by teachers across the nation covers a wide variety of topics. But of the “101 Ways to Create Real Family Engagement,” #77-101 all focus upon the importance of home learning activities. This empowers parents and families to be leaders and role models in their child’s education. Encouraging families to be teachers is essential to ensuring academic learning continues at home. It is more important that families express an interest in learning with a child than it is they are experts.

Ridnour, K. (2011) *Everyday Engagement: Making Students and Parents Your Partners in Learning*

This book compiles proven methods for engaging parents and families, one of which is empowering them to be involved in work and activities that students complete outside of the classroom. If parents understand their vital role and feel capable of contributing meaningfully to their child's education through homework and at-home activities, they will be more inclined to do so. This increased involvement will strengthen parent engagement, and ultimately, increase student success.

Appendix B: Survey Questions

Pre-Survey

What was the number on your activity bag? This does not have any connection to your personal information, it just links your two surveys.

Your answer:

1. How would you rate your child's interest in STEM-oriented (science, technology, engineering, and math) subjects? This scale is 1-5, with "1" indicating the least interest and "5" indicating the most.

1. Least interested
 2. Somewhat interested
 3. Interested
 4. Very interested
 5. Highly interested
- Unsure

2. How would you rate your child's interest in the subject of science? This scale is 1-5, with "1" indicating the least interest and "5" indicating the most.

1. Least interested
 2. Somewhat interested
 3. Interested
 4. Very interested
 5. Highly interested
- Unsure

3. Do you or someone in your immediate family work in a STEM-related field? If yes, please specify.

Your answer:

4. How often do you and your family attend any other science resources in the community such as Imagination Station in Toledo or the BGSU Planetarium? This scale is 1-5, with “1” indicating the least frequency and “5” indicating the most.

1. Never
 2. Once a year
 3. Once every six months
 4. Once a month
 5. Once a week
- Never

5. How important do you think STEM subjects are in your child’s education? This scale is 1-5, with “1” indicating the least importance, and “5” indicating the most.

1. Least important
 2. Somewhat important
 3. Important
 4. Very important
 5. Highly important
- Never

6. How strong is your desire to see your child someday enter a STEM-related field? This scale is 1-5, with “1” indicating the least desire, and “5” indicating the most.

1. Least desire
 2. Somewhat desire
 3. Desire
 4. Very much desire
 5. Highly desire
- Unsure

7. How have you enjoyed your overall STEM in the Park experience? This scale is 1-5, with “1” indicating the least enjoyment, and “5” indicating the most.

1. Least enjoyed
 2. Somewhat enjoyed
 3. Enjoyed
 4. Very much enjoyed
 5. Highly enjoyed
- Unsure

8. How would you rate your child’s STEM education? This is scale is 1-5, with “1” indicating the poorest, and “5” indicating the best.

1. Poor
 2. Somewhat good
 3. Good
 4. Very good
 5. Best
- Unsure

9. Do you wish you had more at-home resources (websites, games, activities, etc.) to engage in STEM learning with your child? If yes, please explain.

Your answer:

10. How do you feel about helping your child in their STEM education? Do you feel satisfied in your ability to help them with homework, talk to them about science and math concepts, etc.? Keep in mind that this survey is anonymous, and any response is welcomed. This scale is 1-5, with “1” indicating the least amount of satisfaction, and “5” indicating the most.

1. Least satisfied
2. Somewhat satisfied

- 3. Satisfied
- 4. Very satisfied
- 5. Highly satisfied
- Unsure

11. How often do you do any STEM-related activities at home? These could include science kits, building with blocks, or STEM-related puzzles and board games. This scale is 1-5, with “1” indicating the least frequency, and “5” indicating the most.

- 1. Never
- 2. Once a month
- 3. Once a week
- 4. Once a day
- 5. More than once a day
- Unsure

Post-Survey

Family-Friendly Science: Survey 2

Hello, and thank you for choosing to complete the second survey for this research project. Your contribution is greatly appreciated; if I have your email on file, you have been entered to win a STEM activities basket for your family. You may take as long as you need, and skip any questions that you do not wish to answer.

What was the number on your activity bag? This does not have any connection to your personal information, it just links your two surveys

Your answer:

1. What is your child's (or children's) age/grade level?

Pre-K

Kindergarten

1st Grade

2nd Grade

3rd Grade

Beyond 3rd Grade

2. Did you and your child(ren) complete the home activities?

Yes

No

Incomplete

3. If no or incompletely, why not?

Your answer:

4. If you did complete the activities, how much did you and your child enjoy them? This scale is 1-5, with "1" being the least amount of enjoyment, and "5" being the most.

1. Least enjoyed

2. Somewhat enjoyed
 3. Enjoyed
 4. Very much enjoyed
 5. Highly enjoyed
- Unsure

5. How often does your child's school send home any learning enrichment materials similar to the ones I gave you? (Family activities or games, anything that does not qualify as traditional pencil and paper "homework.") This scale is 1-5, with "1" being the least frequency, and "5" being the most.

1. Never
 2. Once a year
 3. Once a month
 4. Once a week
 5. Every day
- Unsure

6. If you responded "yes" to question "4," do you enjoy these activities? Do you wish they were sent home more often?

- Yes
- No
- Unsure

7. If you responded "no" to question "4," would you like to see your child bring home more activities such as this?

- Yes
- No
- Unsure

8. How often have you attended or will you attend (if such an event is already scheduled at your child's school) a family engagement event such as STEM in the Park? This scale is 1-5, with "1" being the least frequency, and "5" being the most.

Never

1. Once a year
2. Once every three months
3. Once a month
4. Once every two weeks
5. Once every week

Unsure

9. How did you enjoy your overall STEM in the Park experience? This scale is 1-5, with "1" indicating the least enjoyment, and "5" indicating the most. (This question was also included in the first survey.)

1. Least enjoyed
2. Somewhat enjoyed
3. Enjoyed
4. Very much enjoyed
5. Highly enjoyed

10. If you completed the project, do you feel the project made you feel enabled to contribute to your child's STEM education? This scale is 1-5, with "1" as "least enabled," and "5" as "most enabled."

1. Least enabled
2. Somewhat enabled
3. Enabled
4. Very enabled
5. Highly enabled

Unsure

11. How would you rate your relationship with your child's teacher; how collaborative would you say your relationship is? This scale is 1-5, with "1" being "poor/not collaborative" and "5" being "best/most collaborative."

1. Poor/Not collaborative
 2. Somewhat good/somewhat collaborative
 3. Good/collaborative
 4. Very good/very collaborative
 5. Best/most collaborative
- Unsure

12. Do you have any general feedback for myself or STEM in the Park?

Your answer:

Appendix C: Activity Instructions and Related Materials, Activities 1-3

a) Activity 1: Pre-K to Kindergarten

Dear Families,

Thank you so much for stopping by my table and choosing to participate in this project. Even if you have chosen not to complete the survey, I hope you and your family enjoy the activity! It was designed to accommodate your busy schedules, and incorporates household materials to engage your child. Each packet should contain:

- Two triangular crayons
- Two round crayons
- Five rubber bands of various sizes
- An Investigation Journal

The purpose of this activity is to tie Ohio State Science Standards to short, meaningful explorations of materials. The standards this activity will address are:

- “Objects and materials can be sorted and described by their properties.”
- “Some objects and materials can be made to vibrate to produce sound.”

Both standards are from the Kindergarten level, Physical Science strand.

Please complete the activity as a family, reading the instructions with/to your child. They may require help or supervision for some portions. *SOME MATERIALS ARE SMALL AND POSE A CHOKING HAZARD TO CHILDREN UNDER THREE YEARS OF AGE.* Please do not allow young children to have these materials unsupervised.

Thank you again for completing the activity! I hope you and your family have a wonderful time. After completing the activity, please complete the post survey at

https://docs.google.com/forms/d/e/1FAIpQLSelfUPD9kWm5gLcScgbCw_cZ1yjNrflmg_wWML9240N9_ww/viewform

If you have any questions, please do not hesitate to contact me at balison@bgsu.edu.

Happy investigating!

Sincerely,

Alison Bixler, Inclusive Early Childhood Education Student

Instructions

Part 1:

For the first activity, lay out the crayons. What ways could you sort them? Could you sort them by color? Try rolling them. Is one shape harder to roll than the other? How could you sort them now? Draw what you think in your investigation journal!

Part 2:

For the second activity, stretch out the rubber bands. Have everyone in your family pluck them like guitar strings. What kind of sound does it make? Try it with each rubber band. Can you sort these rubber bands based on how they sound?

Part 3:

For the last activity, you will need different things around your house. Some examples might be a table, a chair, or a dollhouse. Start by pushing on the objects (get adult permission first!) and see which ones you can move. Which are harder to move? Which are easier to move? Record this in your journal!

Conclusion:

There are all kinds of ways to sort objects! It's easy to just sort them by color, but there are so many different ways to try. Sometimes you can sort things because of how they look, or you can sort them because of how they sound. What about sorting them by how they feel? What things around you are soft? What ones are rough? Draw them below:

Investigation Journal



Pre-K to Kindergarten

Investigation Journal



Pre-K to Kindergarten

Draw how you sorted your
crayons:

What was the hardest thing to
push?

Draw how you sorted your
crayons:

What was the hardest thing to
push?

Which rubber band made a
high sound?

Which rubber band made a low
sound?

Which rubber band made a
high sound?

Which rubber band made a low
sound?

What was the easiest thing to
push?

Which kind of crayon was easy
to roll?

What was the easiest thing to
push?

Which kind of crayon was easy
to roll?

b) Activity 2: Grade One to Two

Dear Families,

Thank you so much for stopping by my table and choosing to participate in this project. Even if you have chosen not to participate, I hope you and your family enjoy the activity! It was designed to accommodate your busy schedules, and incorporates household materials to engage your child. Each packet should contain:

- One container of modeling dough
- Five rocks
- A toy car
- An Investigation Journal

The purpose of this activity is to tie the Ohio State Science Standards to short, meaningful explorations of materials. The standards this activity will address are:

- “Properties of objects and materials can change.”
- “Forces change the motion of an object.”

The first standard is from Grade 1, while the second is from Grade 2. Both are from the Physical Science strand.

Please complete the activity as a family, reading the instructions with/to your child. They may require help or supervision for some portions. *SOME MATERIALS ARE SMALL AND POSE A CHOKING HAZARD TO CHILDREN UNDER THREE YEARS OF AGE.* Please do not allow young children to have these materials unsupervised.

Thank you again for completing the activity! I hope you and your family have a wonderful time. After completing the activity, please complete the post survey at

https://docs.google.com/forms/d/e/1FAIpQLSelfUPD9KWm5gLcScgbCw_cZ1yjNrflmg_wWMLg24oN9_ww/viewform.

If you have any questions, please do not hesitate to contact me at balison@bgsu.edu.

Happy investigating!

Sincerely,

Alison Bixler

Inclusive Early Childhood Education Student

Instructions

Part 1:

For the first activity, you will need to pick small objects from around the house. These could be books, cups, or small toys. Make sure you have adult permission first! Try pushing each object across a table. Then, try pushing the small car in the materials packet. Which was easiest to push across the table? Why did the same thing happen with all the objects? Write your answers in your investigation journal!

Part 2:

For the second activity, open the container of modeling dough. Then, grab the modeling dough in one hand while grabbing a rock with the other. Squeeze as hard as you can squeeze! What happens to each object? Why do you think this happens? Write your answers in your investigation journal!

Part 3:

For the third activity, you will need to create salt water. Mix one part water with one part salt. Make sure an adult is supervising! Then, fill half of an ice cube tray with the salt water. Fill the other half with fresh tap water. Place it in the freezer for several hours. Take it out, and record what you find!

Conclusion:

You just changed different objects! Even if you do the same thing to many different objects, the same thing won't always happen! This depends on what the object is, and what you are trying to do to it. Can you think of two things that, even when you try to change them the same way, react differently? Write about them below:

Investigation Journal



First and Second Grade

Investigation Journal



First and Second Grade

What things, besides the car,
did you push across the table?

Why do you think the two types
of water didn't change the same
way?

Did the same thing happen
for every object you pushed
across the table?

What things, besides the car,
did you push across the table?

Why do you think the two types
of water didn't change the same
way?

Did the same thing happen
for every object you pushed
across the table?

Which thing is harder?

What other things might change the same way as the modeling dough?

Did the modeling dough and the rocks change the same way?

What other things might change the same way as the rocks?

Which thing is harder?

What other things might change the same way as the modeling dough?

Did the modeling dough and the rocks change the same way?

What other things might change the same way as the rocks?

What happened to the fresh
water?

How could you make it as easy
to move the other objects as it
was the car?

What happened to the salt
water?

What happened to the fresh
water?

How could you make it as easy
to move the other objects as it
was the car?

What happened to the salt
water?

c) Activity 3: Third Grade and Beyond

Dear Families,

Thank you so much for stopping by my table and choosing to participate in this project. Even if you have chosen not to complete the survey, I hope you and your family enjoy the activity! It was designed to accommodate your busy schedules, and incorporates household materials to engage your child. Each packet should contain:

- String and two cups
- Two color tablets
- Two containers of modeling dough
- An Investigation Journal

The purpose of this activity is to tie Ohio State Science Standards to short, meaningful explorations of materials. The standards this activity will address are:

- “Matter exists in different states, each of which has different properties.
- “The total amount of matter is conserved when it undergoes a change.”

The first standard is from Grade 3, while the second is from Grade 4. Both are from the Physical Science strand.

Please complete the activity as a family, reading the instructions with/to your child. They may require help or supervision for some portions. *SOME MATERIALS ARE SMALL AND POSE A CHOKING HAZARD TO CHILDREN UNDER THREE YEARS OF AGE.* Please do not allow young children to have these materials unsupervised.

Thank you again for completing the activity! I hope you and your family have a wonderful time. After completing the activity, please complete the post survey at

https://docs.google.com/forms/d/e/1FAIpQLSelfUPD9kWm5gLcScgbCw_cZ1yjNrflmg_wWML9240N9_ww/viewform

If you have any questions, please do not hesitate to contact me at balison@bgsu.edu.

Happy investigating!

Sincerely,

Alison Bixler

Inclusive Early Childhood Education Student

Instructions

Part 1:

For the first activity, select a small food item. This could be a pizza roll, apple slice, or anything else that is safe to put in a microwave. Using the instructions for creating a scale using the cup and string, create a scale with which you can measure the item. Follow along in your investigation journal, and use adult supervision! Then, measure the item before and after heating it. What were your findings?

Part 2:

For the second activity, open the two containers of modeling dough. Break off a small piece of each. Without combining them, weigh them in your scale. Record what you find. Then, mash them together as hard as you can! Mix it until it's all one color! Weigh the dough again, and record what you find.

Part 3:

For the third activity, place water in one side of the scale. Weigh it, and record what you find. Then, add a color tablet. Watch it change! Weigh the water again, and record your findings.

Conclusion:

No matter what you do to an object, you can't make its matter (the stuff it's made of!) go away. You can heat things, mix things, and mash things, but the amount of matter stays the same! What are some other changes that you could do to these objects? Write about them below:

Investigation Journal



Third Grade and Above

Investigation Journal



Third Grade and Above

What food did you choose to microwave?

In any of these experiments, do you think you changed how much you were weighing?

Draw how the scale looked when you weighed the food before adding heat.

What food did you choose to microwave?

In any of these experiments, do you think you changed how much you were weighing?

Draw how the scale looked when you weighed the food before adding heat.

Draw how the scale looked when you weighed the two balls of modeling dough before mixing them.

What happened? Why do you think this happened?

Draw how the scale looked after.

Draw how the scale looked when you weighed the two balls of modeling dough before mixing them.

What happened? Why do you think this happened?

Draw how the scale looked after.

Draw how the scale looked when you weighed the water before adding a color tablet.

Draw how the scale looked when you weighed the food after adding heat.

Draw how the scale looked after.

Why do you think this happened?

Draw how the scale looked when you weighed the water before adding a color tablet.

Draw how the scale looked when you weighed the food after adding heat.

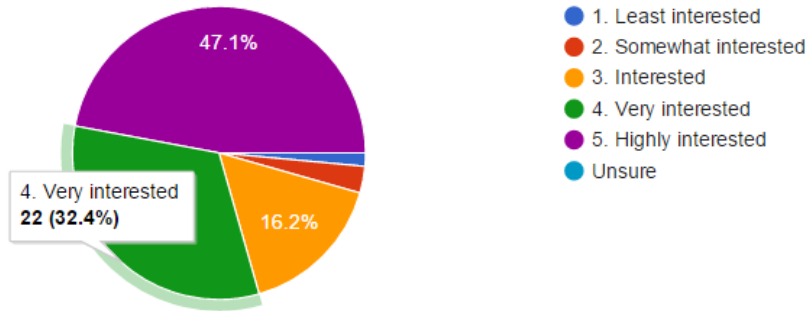
Draw how the scale looked after.

Why do you think this happened?

Appendix C: Raw Data

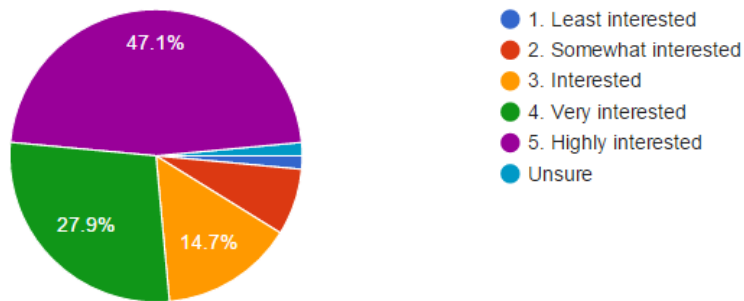
1. How would you rate your child's interest in STEM-oriented (science, technology, engineering, and math) subjects? This scale is 1-5, with "1" indicating the least interest and "5" indicating the most.

(68 responses)



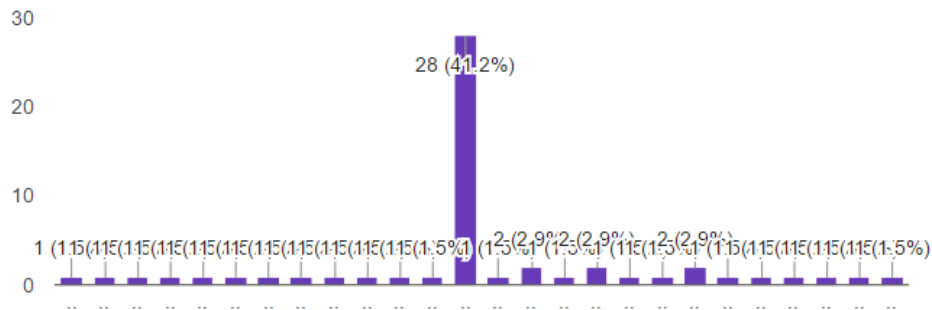
2. How would you rate your child's interest in the subject of science? This scale is 1-5, with "1" indicating the least interest and "5" indicating the most.

(68 responses)



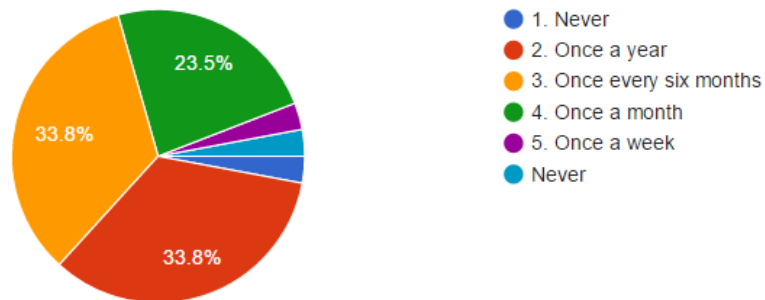
3. Do you or someone in your immediate family work in a STEM-related field?
If yes, please specify.

(56 responses)



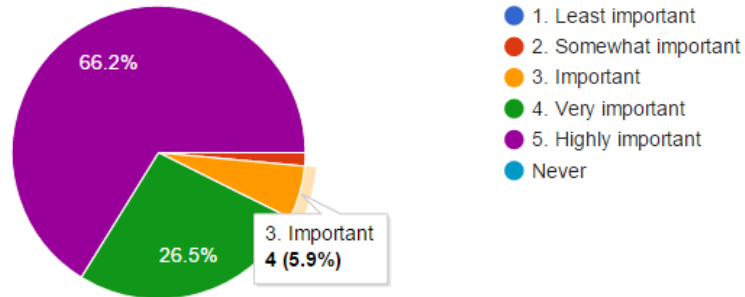
4. How often do you and your family attend any other science resources in the community such as Imagination Station in Toledo or the BGSU Planetarium? This scale is 1-5, with “1” indicating the least frequency and “5” indicating the most.

(68 responses)



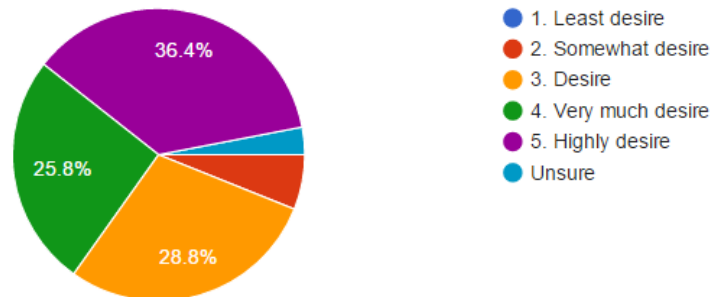
5. How important do you think STEM subjects are in your child's education? This scale is 1-5, with "1" indicating the least importance, and "5" indicating the most.

(68 responses)



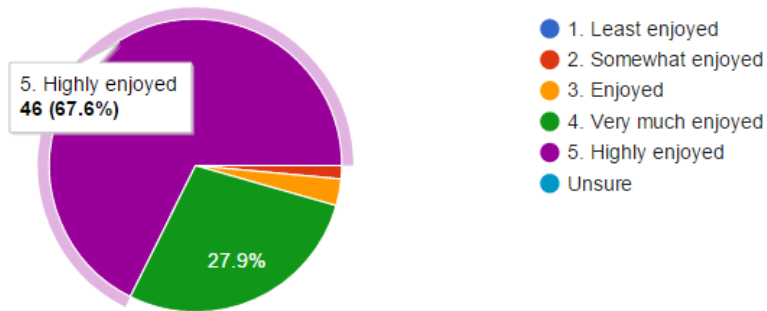
6. How strong is your desire to see your child someday enter a STEM-related field? This scale is 1-5, with "1" indicating the least desire, and "5" indicating the most.

(66 responses)



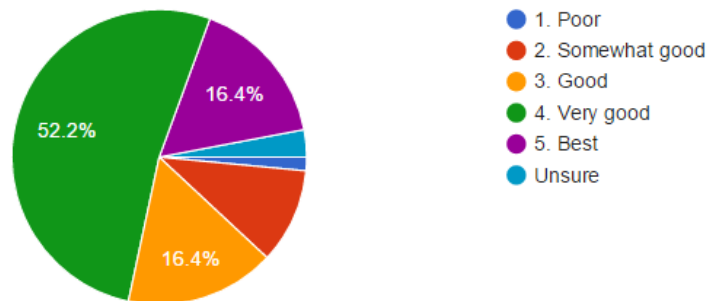
7. How have you enjoyed your overall STEM in the Park experience? This scale is 1-5, with "1" indicating the least enjoyment, and "5" indicating the most.

(68 responses)



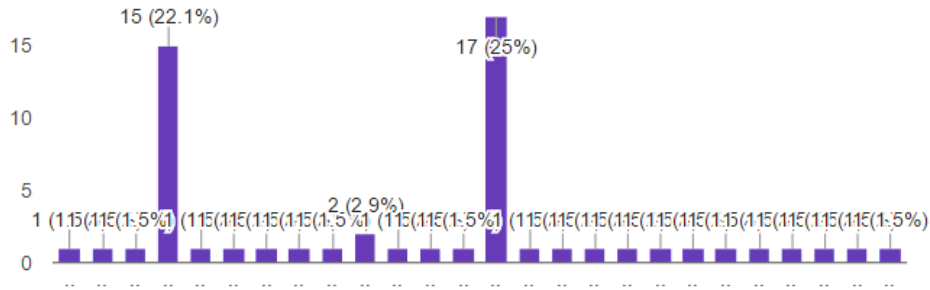
8. How would you rate your child's STEM education? This is scale is 1-5, with "1" indicating the poorest, and "5" indicating the best.

(67 responses)



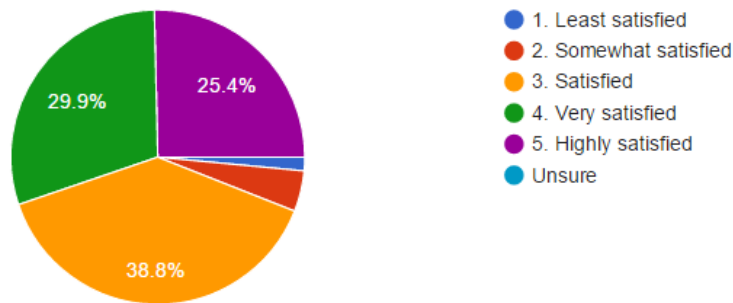
9. Do you wish you had more at-home resources (websites, games, activities, etc.) to engage in STEM learning with your child? If yes, please explain.

(57 responses)



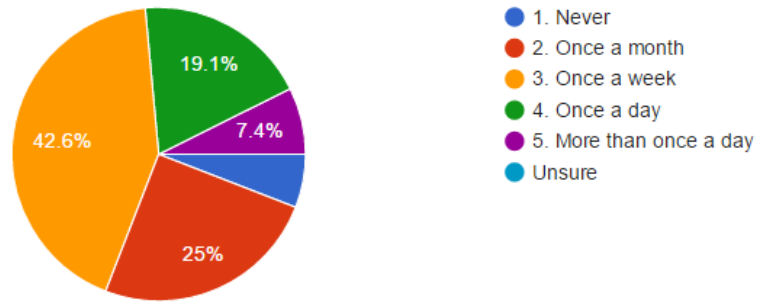
10. How do you feel about helping your child in their STEM education? Do you feel satisfied in your ability to help them with homework, talk to them about science and math concepts, etc.? Keep in mind that this survey is anonymous, and any response is welcomed. This scale is 1-5, with "1" indicating the least amount of satisfaction, and "5" indicating the most.

(67 responses)



11. How often do you do any STEM-related activities at home? These could include science kits, building with blocks, or STEM-related puzzles and board games. This scale is 1-5, with "1" indicating the least frequency, and "5" indicating the most.

(68 responses)



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